



# Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete<sup>1</sup>

This standard is issued under the fixed designation C1064/C1064M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

## 1. Scope\*

1.1 This test method covers the determination of temperature of freshly mixed hydraulic-cement concrete.

1.2 The values stated in either SI or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 The text of this standard references notes and footnotes that provide explanatory information. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. (Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.<sup>2</sup>)*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>3</sup>

C172 Practice for Sampling Freshly Mixed Concrete

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

## 3. Significance and Use

3.1 This test method provides a means for measuring the temperature of freshly mixed concrete. The measured tempera-

ture represents the temperature at the time of testing and may not be an indication of the temperature of the freshly mixed concrete at a later time. It may be used to verify conformance to a specified requirement for temperature of concrete.

3.2 Concrete containing aggregate of a nominal maximum size greater than 75 mm [3 in.] may require up to 20 min for the transfer of heat from aggregate to mortar. (See ACI Committee 207.1R Report.<sup>4</sup>)

## 4. Apparatus

4.1 *Container*, shall be large enough to provide at least 75 mm [3 in.] of concrete in all directions around the sensor of the temperature measuring device; concrete cover must also be at least three times the nominal maximum size of the coarse aggregate.

4.2 *Temperature Measuring Device*, shall be capable of accurately measuring the temperature of the freshly mixed concrete to  $\pm 0.5^\circ\text{C}$  [ $\pm 1^\circ\text{F}$ ] throughout a range of  $0^\circ$  to  $50^\circ\text{C}$  [ $30^\circ$  to  $120^\circ\text{F}$ ]. The design of the temperature measuring device shall be such that it allows 75 mm [3 in.] or more immersion during operation.

4.3 Partial immersion liquid-in-glass thermometers (and possibly other types) shall have a permanent mark to which the device must be immersed without applying a correction factor.

4.4 *Reference Temperature Measuring Device*, shall be readable and accurate to  $\pm 0.2^\circ\text{C}$  [ $0.5^\circ\text{F}$ ] at the verification points in 5.1. A certificate or report that verifies the accuracy shall be available in the laboratory for review. Accuracy of liquid-in-glass reference temperature measuring devices shall be verified once. Verification of direct-reading resistance reference temperature measuring devices shall be performed every twelve months. The certificate or report shall provide documentation that the reference standard used in the verification is traceable to the National Institute of Standards and Technology (NIST).

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.60 on Testing Fresh Concrete.

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<sup>2</sup> Section on Safety Precautions, Manual of Aggregate and Concrete Testing, *Annual Book of ASTM Standards*, Vol 04.02.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>4</sup> Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, <http://www.concrete.org>.

## **5. Verification of the Accuracy of Temperature Measuring Devices**

5.1 The accuracy of each temperature measuring device used for determining the temperature of freshly mixed concrete shall be verified annually, or whenever there is a question of accuracy. Verify the accuracy of the temperature measuring device by comparing the readings of the reference temperature measuring device to the temperature measuring device at two temperatures at least 15 °C [30 °F] apart.

5.2 Verification of the accuracy of the temperature measuring devices may be made in oil or other suitable bath liquids having uniform density if provision is made to:

5.2.1 Maintain the bath temperature constant within 0.2 °C [0.5 °F] during the verification process.

5.2.2 Continuously circulate the bath liquid to provide a uniform temperature throughout the bath.

5.2.3 Suspend the temperature measuring devices in such a manner that the devices are not contacting the sides or bottom of the bath container during verification.

5.3 Place both the temperature and reference temperature measuring devices in the bath for at least 5 min before reading temperatures at the test points specified in 5.1.

5.4 Prior to reading the temperature measuring devices, if the temperature in the bath has been reduced, slightly tap thermometers containing liquid to avoid adhesion of the liquid to the glass.

5.5 Read and record the temperature of both the reference temperature measuring device and the temperature measuring device. Reject the temperature measuring device if the difference in readings exceeds 0.5 °C [1 °F] at either test point. If the indicator of the rejected temperature measuring device is adjustable, reverification is permitted after adjustment. In addition to the temperature readings, record the identification numbers of both devices used, the date verified, and the name of individual performing the verification.

## **6. Sampling Concrete**

6.1 It is acceptable to measure the temperature of freshly mixed concrete in either the transporting equipment or the forms after discharge provided the sensor of the temperature measuring device has at least 75 mm [3 in.] of concrete cover in all directions.

6.2 If the transporting equipment or placement forms are not used as the container, a sample shall be prepared as follows:

6.2.1 Immediately, prior to sampling the freshly mixed concrete, dampen (with water) the sample container.

6.2.2 Sample the freshly mixed concrete in accordance with Practice C172, except that composite samples are not required if the only purpose for obtaining the sample is to determine temperature.

6.2.3 Place the freshly mixed concrete into the container.

## **7. Procedure**

7.1 Position the temperature measuring device so that the end of the temperature sensing portion is submerged a minimum of 75 mm [3 in.] into the freshly mixed concrete. Close the void left by the placement by gently pressing the concrete around the temperature measuring device at the surface of the concrete to prevent ambient air temperature from affecting the reading.

7.2 Leave the temperature measuring device in the freshly mixed concrete for at least 2 min but not more than 5 min, then read and record the temperature to the nearest 0.5 °C [1 °F]. Do not remove the device from the concrete when reading the temperature.

## **8. Report**

8.1 Report the measured temperature of the freshly mixed concrete to the nearest 0.5 °C [1 °F].

## **9. Precision and Bias**

9.1 The data used to develop the precision statement were obtained using the inch-pound version of this test method. The precision indices shown in SI units are conversions of the values in brackets.

9.2 The single operator standard deviation for measurement of concrete temperature has been found to be 0.3 °C [0.5 °F].<sup>5</sup> Therefore, results of two properly conducted tests by the same operator on the same sample of material should not differ by more than 0.7 °C [1.3 °F].<sup>5</sup>

9.3 The multi-operator standard deviation for the measurement of concrete temperature on the same sample has been found to be 0.4 °C [0.7 °F].<sup>5</sup> Therefore, two tests properly conducted by different operators but on the same material should not differ by more than 1.1 °C [1.9 °F].<sup>5</sup>

9.4 The precision values given were derived from an inter-laboratory study using 11 operators on two concrete batches at around 24 °C [75 °F].<sup>6</sup>

9.5 Since there is no accepted reference material suitable for determining the bias of this test method, no statement on bias is being made.

## **10. Keywords**

10.1 freshly mixed concrete; temperature; temperature measuring device

<sup>5</sup> These numbers represent, respectively, the (1s) and (d2s) limits as described in Practice C670.

<sup>6</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:C09-1028.

**SUMMARY OF CHANGES**

Committee C09 has identified the location of selected changes to this specification since the last issue, C1064/C1064M–11, that may impact the use of this specification. (Approved December 1, 2012)

(1) Added new **9.1** to indicate that precision values were obtained using the inch-pound version of the test method and renumbered subsequent subsections.

Committee C09 has identified the location of selected changes to this specification since the last issue, C1064/C1064M–08, that may impact the use of this specification. (Approved December 1, 2011)

(1) Revised **1.2** to conform to the ASTM Form and Style.

(2) Revised Section **5** to require documentation of verification, list the tolerance for rejecting thermometers, clarify the requirements for a liquid bath, and change the term used from “calibration” to “verification.”

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